

COLORED OR FRAGRANCED HORTICULTURAL/AGRICULTURAL PRODUCTS

Related Patent Applications

The application is a continuation-in-part of 09/544,878 filed April 17, 2000, which is a continuation-in-part of U.S. patent application No. 09/113,254 filed July 10, 1998. The application is also a continuation-in-part of 09/510,782 filed February 23, 2000.

Field of the Invention

The present invention relates to horticultural products and a method for making gardening products which have a dye or fragrance added to the products.

Background of the Invention

Mulches are commonly applied over grass seed beds. Mulches help to increase seed germination and decrease soil erosion allowing seeds to become firmly established in the seeded area. Mulches typically consist of straw, wood shavings, or paper. In the prior art, mulches are mixed with water and agitated in a holding tank, and then sprayed onto a seed bed. Some mulches are woven into blankets that are designed to be laid down over seed beds. Some mulches are chemically bonded natural fiber spray-applied mulches. These mulches use a vegetable gum binder such as guar gum to bind together natural fibers.

Most mulches are loose configurations of unbonded fibers that easily wash away. Paper-based mulches tend to bond into a paper mache-like mat that inhibits oxygen and sunlight transfer, and the ability of seedlings to emerge through the mulch, affecting

vegetation establishment. Chemically-bonded mulch forms an almost impenetrable layer over the seed bed that is poor at passing oxygen and water through to the seed bed.

Horticultural/Agricultural growers, gardeners, landscape operators, flower growers, and the like produce a wide variety of cultivated plants. Many such crops are grown from seed. The sizes, shapes, and physical characteristics of the various kinds of seeds are as varied as the number of crops produced therefrom.

Producers of such cultivated crops encounter a variety of challenges in handling and distributing such seed, as well as with sowing of such seed in suitable growing media. Certain seed may desirably be sowed by a broadcast method if the seed were compatible with broadcast application. For example, grass seed for lawns is desirably broadcast, but the low density and generally non-aerodynamic shape of some grass seed can limit the range of such broadcast, and make such seed susceptible to being blown about by wind, or washed away by surface water, even if initially well placed in a good seeding application.

Another difficulty encountered in sowing seed is that the seed may be so small as to be difficult to handle, thereby to place properly-spaced seeds at a desired spacing as to make cost-effective use of the seed, thereby to produce a crop of the related plants without using any more seed than necessary, thus to gain maximum benefit from the amount of seed used.

While small seed may be efficiently handled by industrial equipment especially designed for handling such seed, typically the user of such seed also handles various other types of seed; and may be unable to justify the cost of such specialty seed-handling equipment. Rather, the seed user typically has a limited range of seed handling

equipment which must be capable of being used and/or adapted to handle and apply all the types of seeds being used by that user. Where the seed itself can be adapted to the equipment, specialty seed can be handled without need for any specialized equipment.

Even where the seed may be sown by hand, such as seedling or bedding trays or pots, some seeds are so small as to be difficult for the sower/user to effectively manipulate and control by hand. Typical of such difficult to handle seeds are seeds of lettuce, carrots, the cabbage family, ground cherries, and alfalfa. Many flower seeds are equally small and/or difficult to handle and/or manipulate, for example poppy seed.

A properly conditioned soil has advantageous soil chemistry in combination with advantageous soil texture. Thus, in addition to providing specific plant nutrients, soil users also use products that modify basic soil chemistry, and soil texture.

Basic soil chemistry is modified by adding to the soil, for example, calcium products to provide pH control, and flyash or like products to provide pH control as well as micronutrients.

U.S. Patent 4,761,423 relates to a seed dressing applied to winter wheat, bean, pea or sorghum seed to protect the seed from insect or fungal damage. The seed dressing comprises animal, vegetable or mineral oil, an emulsifier, dyestuff and water.

U.S. Patent 4,368,591 relates to seeds with an active ingredient and between 0.035 and 1.80 g of titanium dioxide per kg of seed in either the rutile or anatase form. The titanium dioxide serves, in conjunction with a coloring agent, to provide a bright, opaque coating to the seed.

U.S. Patents 4,881,343 and 4,853,429 relate to a seed colorant useful especially in coloring seeds to distinguish same from the seeds to be used for foods is formed of an

aqueous medium such as water, a dye and/or pigment of a desired hue, and a binder resin composed of the salt of chitosan and an organic acid. The seed colorant may additionally contain spherical resin particles.

U.S. Patent 5,087,475 relates to a process for the film-coating of seed materials. A batch of seed materials is film coated with a gas and water permeable, thin, adherent, uniform non-phytotoxic continuous liquid surface film of a polymeric film former.

U.S. Patent 5,543,321 relates to a sterilized plant culture medium comprising a dye in an amount which imparts a visible color to the culture medium and which permits seed germination is provided which is useful for attracting children, for observing and studying seed germination, root and shoot formation and whole plant development, and for color-coding plant cultures.

U.S. Patents 5,308,653 and 5,192,587 relate to a comminuted wood that is converted to a colored wood product useful as a mulch. The product is produced by feeding a comminuted wood into a screw conveyor. The comminuted wood is contacted in the lower end of the conveyor by a liquid color-imparting agent, preferably an aqueous solution containing iron oxide pigment, carbon black pigment or a mixture of both pigments. After contacting, rotation of the auger draws the moist colored wood product towards the upper end, permitting runoff of excess liquid agent, which returns by gravity to the basin for further contacting with newly-fed comminuted wood. Colored wood product discharges through a chute at the upper end of the conveyor for further drying, if necessary.

U.S. Patent 5,235,781 relates to a compacted agglomerate in the form of a pillow-shaped briquette. It contains finely pulverized paper and a fertilizer in the form of a

granular powder or liquid. The pulverized paper may be paper dust. A dye may also be added to provide a more colorful product.

U.S. Patent 6,076,299 relates to mulching pellets made from finely divided paper and wood, a clay binder, a highly water absorbent natural polymer, and a surfactant. The pellets absorb at least four times their weight in water. The pellets substantially reduce water run-off and soil erosion as compared to other mulch pellets.

U.S. Patent 6,021,598 relates to a pourable, granular paper mulch product. A dye or a combination of dyes are used which will impart to the mulch product a color which resembles that of actual grass, a green color.

U.S. 5,853,541 relates to a degradable agricultural mulch, mat or ground cover including cotton linters fibers, hardwood kraft pulp fibers, softwood kraft pulp fibers, and a water holdout material which is strong enough to be laid mechanically and is 100% photo- or biodegradable.

U.S. Patent 5,585,150 relates to a biodegradable mulch product comprising sheets or finely divided particles of cellulosic fibrous material bonded together with a bonding agent comprising a water-based bonding adhesive and compressed to form a laminar layer, said compressed laminar layer being cut into mulch-size pieces that simulate natural tree mulches in appearance, density and rate biodegradation.

U.S. Patent 4,932,156 relates to a method for controlling the color of mulch for retarding the fading of the color of the mulch and/or restoring the color of mulch that has faded due to prolonged exposure to actinic light and ambient weather conditions by applying a brown color-control solution to the surface of the mulch.

U.S. Patent 4,232,480 relates to a viscous liquid containing dye and possibly further additives is added to a package of hydraulic mulch material for hydraulic mulching. The viscous liquid and its additive are suitable to be later uniformly mixed through the hydraulic mulch during subsequent mixing and agitation with water prior to application, thereby eliminating the need for precoloring of the mulch material.

U.S. Patent 4,067,140 relates to a mulch having finely divided fibers of paper coated with a wetting agent and preferably dyed a pleasing color such as green. To produce the mulch, finely divided fibers of paper are coated with a mixture of a solvent or carrier such as water, wetting agent and a dye. The finely divided fibers of paper are contacted with the mixture such as by tumbling the fibers of paper while spraying the mixture into the drum.

U.S. Patent 6,021,598 relates to a pourable, granular paper mulch product including a granular solid comprising at least about 85% paper by weight and at least 6% water by weight, and having a settled density of at least about 15 pounds per cubic foot is prepared by comminuting paper, mixing the comminuting paper with water to form a pulp, extruding the pulp through a die orifice, chopping the extrudate to a length of less than about 1/8 inch to form granules, and drying the granules to achieve a final moisture content of from about 6% to about 13% by weight.

U.S. Patent 4,339,890 relates to a dry seeding mulch having finely shredded or ground particles of waste paper mixed with a dry powdered chemical wetting agent and injected, after bagging, with a concentrated dye mixture which imparts color to the entire bag of mulch when mixed with water by the ultimate user. The dye is added to the finely shredded paper and the dye crystallizes and changes color.

The prior art does not teach a horticultural product, such as a seed or mulch that has a fragrance added to it. The prior art does not teach adding a dye to a coating of a seed.

Summary of the Invention

The present invention relates to a product and method for colored and fragranced horticultural/agricultural products. The present invention relates to a colored seed comprising a seed, a binder, a coating surrounding the seed, and a dye and/or pigment within and/or on said coating. It is an object of the present invention for the dye to be capable of changing colors based on the acidity of soil. It is a further object of the present invention to provide a dye being capable of changing colors in response to the moisture content added to the soil. It is a further object of the invention to provide a dye being capable of changing colors depending on the chemical content of the soil. It is a further object of the invention to provide a dye being capable of deterring animals from eating the seed.

It is an object of the present invention for the dye to be selected from a group consisting of acid, basic and/or direct dye concentrates. It is an object of the present invention for the dye to be florescent. It is an object of the present invention for the dye to be an environmentally friendly chemical composition. It is an object of the present invention where the dye comprises glycerin or water and a colorant. It is an object of the present invention for the coating surrounding the seed to comprise a solid material. It is an object of the present invention for the coating made of solid material to be pre-dyed. It is an object of the present invention for the colored seed to be seen during application of the seed. It is an object of the present invention for the colored seed to be located after

application of the seed. It is an object of the present invention for the colored seed to be of the similar or same color of the actual plant, flower, fruit or vegetable. It is a further object of the invention for the colored seed to assist the seed in absorbing heat. It is an object of the present invention for the colored seed to assist the seed in reflecting light.

The present invention relates to a fragranced seed comprising; a seed and a fragrance. It is an object of the invention for the fragrance to assist a user in determining the acidity of soil. It is an object of the invention for the fragrance to assist a user in determining moisture content of soil. It is an object of the invention for the fragrance to assist a user in determining chemical content of soil. It is an object of the invention for the fragrance to deter animals from eating said seeds. It is an object of the invention for the fragrance to be selected from a group consisting of a floral fragrance, a natural fragrance or cocoa. It is an object of the invention for the fragrance to be approved for use in products directly applied to the skin. It is an object of the invention for the fragrance to provide a scent which can take on a scent similar to a scent of a product applied. It is an object of the invention for the fragrance to assist a user in locating the seed after application of the seed.

The present invention relates to a colored mulch product consisting essentially of; a material comprising a fiber, cellulose, clay, loam, sand , and/or a combination of same; a binding agent; and a dye and/or pigment. It is an object of the invention for the colored mulch to further comprise NPK fortifiers. It is an object of the invention for the dye of the colored mulch assists a user in determining the acidity of soil. It is an object of the invention for the dye of the colored mulch to assist a user in determining moisture content of soil. It is an object of the invention for the dye of the colored mulch to assist a

user in determining chemical content of soil. It is an object of the invention for the dye to be selected from a group consisting of acid, basic or direct dye concentrates. It is an object of the invention for the dye to be florescent. It is an object of the invention for the dye to be an environmentally friendly chemical composition. It is an object of the invention for the dye to comprise glycerin or water and a colorant. It is an object of the invention for the dye of the colored mulch to deter animals from eating a seed. It is an object of the invention for the mulch to assist the seed in absorbing heat. It is an object of the invention for the colored mulch to reflect light. It is an object of the invention for the mulch to have the color of the actual plant, flower, fruit or vegetable of a seed planted with said mulch.

The present invention relates to a fragranced mulch comprising; a mulch product; and a fragrance. It is an object of the invention for the fragranced mulch to assist a user in determining the acidity of soil. It is an object of the invention for the fragranced mulch to assist a user in determining moisture content of soil. It is an object of the invention for the fragrance to assist a user in determining chemical content of soil. It is an object of the invention for the fragrance to be selected from a group consisting of a floral fragrance, a natural fragrance or cocoa. It is an object of the invention for the fragrance to be approved for use in products directly applied to the skin. It is an object of the invention for the fragrance to provide a scent, which can take on a scent similar to a scent of a product applied.

The present invention relates to a process for coloring seeds comprising; coating a seed with a slurry, paste, or solid coating, adding a binding agent and adding a dye to the

coating either prior to the coating being added to the seed, during the coating, or after the coating is added to the seed.

The present invention relates to a colored mulch product comprising; a material comprising a fiber, cellulose, clay, loam or sand and/or a combination of same, a binding agent; and a dye and/or pigment. The colored mulch product is produced by an agglomeration operation.

The present invention relates to a colored seed product comprising; a seed, a binder, a coating; and a dye and/or pigment within and/or on the coating. The colored seed product is produced by an agglomeration operation.

The present invention relates to a colored seed product wherein the color fades or disappears in response to a lack of fertilizer. The present invention relates to a colored mulch product wherein the color fades or disappears in response to a lack of nutrient or fertilizer in the mulch.

It is an object of the present invention to provide dyes to seeds and mulches for color accents and for ease in determining where the products are located. It is an object of the present invention to provide a scent to a seed or mulch to assist a user in determining where the products are located. It is a further object of the invention to provide a scent to seeds and mulches which can take on a scent similar to the scent of the product applied (floral, grass, natural), or one that is of general appeal to applicators (Cocoa, etc.).

It is an object of the present invention to provide the dye to a coating that is applied to a seed. It is an object of the present invention to use both liquid dyes and dry pigments.

The present invention relates to a method for adding a color to a gardening product. Dyes are added to a gardening product, such as, a mulch by homogeneously blending the colorant either before or at an agglomeration step. It can also be surface applied (wet or dry) after the agglomeration step.

One such example of this agglomeration is a lifting and tumbling agglomeration. A moist fiber based product, which can be impregnated with fortifiers such as NPK, is placed in a mixer. The mixer performs the work that results in an agglomerated (or granulated) product. This product is then dried to a desired level of moisture and screened as necessary. A binding agent can be added at the mixer to enhance the agglomeration/granulation process. If a binding agent is added the fiber based product, the product need not be moist.

The same methodology can be used for adding fragrances.

When dyes or fragrances are added to seeds, they can be added by blending them before or at the agglomeration step. They can be applied along with or mixed with binders in the same agglomeration step. It can also be surface applied (wet or dry) after the agglomeration step. Dyes can also be added to the seed by using pre-dyed solid material as the coating material.

It is an object of the present invention to provide a dye or fragrance to a seed or mulch, which assists a user in determining the chemical content of the soil, such as whether there is enough nitrogen.

Brief Description of the Drawings

FIGURE 1 is a transverse cross-sectional view of a coating drum suitable for spray-coating substrate seed according to the present invention.

FIGURE 2 is a partially cut away view showing a length of the drum of FIGURE 1.

FIGURE 3 is a schematic representative flow diagram illustrating a first manufacturing process for producing combination seed capsule product of the invention.

FIGURE 4 is a block diagram illustrating a second manufacturing process for producing combination seed capsule product of the invention.

FIGURE 5 is a schematic representative flow diagram illustrating a third manufacturing process for producing combination seed capsule product of the invention.

FIGURE 6A, 6B, 6C, and 6D show cross sections of seed capsules of the invention.

FIGURE 7 illustrates a cross-section of the soil root zone, and a representative population of seed capsules at the top surface of the soil.

FIGURE 8 illustrates a single seed capsule on the soil surface, and the micro-environment developing about the seed capsule.

Detailed Description of the Invention

The present invention relates to a product and method for colored and fragranced gardening products. The present invention provides dyes to seeds and mulches for color accents and for ease in determining where the products are located. The present invention provides a scent to a seed or mulch, which assists a user in determining where the products are located. For example, if a user is planting multiple seeds, but the seeds have a similar appearance, the use of a color or fragranced seed can assist in user in determining the seeds they are planting.

The present invention uses a wide range of colorants for coloring the gardening product. Both liquid dyes and dry pigments can be used. Concentrated solid colorants include, acid, basic and direct dye concentrates. Fluorescent and glow in the dark concentrates exhibited favorable results used alone or added to other pigments and dyes. Water-soluble dyes such as direct liquid dyes; basic liquid dyes; acid liquid dyes; and food drug and cosmetic colorants can be employed. Color is not a limiting factor. All pigments and shades tested with the present invention colored the mulch product. Numerous variations in color concentration were tested. Color intensity increased with an increase in colorant.

In a preferred embodiment, food, drug and cosmetic colorants were chosen for their environmentally friendly chemical composition. Liquid dyes were chosen, for water is already added to the current system. The most uniform and rapid mixing of the constituent was achieved with a liquid colorant. The use of a liquid colorant also kept the equipment costs relatively low. A dye including glycerin, water, and colorant created the best adsorption and vivid color. In a preferred embodiment, the dye is concentrated so that 50-75 pounds per hour of dye is incorporated into the system during full operating capacity.

A varied sample of industrial and cosmetic fragrances was tested to determine the ability to create scented fortified mulch and seeds. Cosmetic earthy scents such as: rose, lilac, bluebonnet, gardenia, grass heather, cedar wood, sage and harmony was sampled. These samples are IFRA (International Fragrance Association) approved for use in products directly applied to the skin. All samples tested were successful in absorbing the scent into the product.

Gardenia (8476) was the chosen fragrance. The fragrance was chosen because of its scent and cost. Gardenia (8476) is a commonly used fragrance in cosmetics such as soaps and lotions, and has an environmentally friendly chemical composition. In a preferred embodiment, an application rate of 0.002 pounds for a five pound container was used.

In a further embodiment, the present invention provides a scent which can take on a scent similar to the scent of the product applied (floral, grass, natural), or one that is of general appeal to applicators (Cocoa, etc.).

The present invention further relates to a method for adding a color to a gardening product. Dyes are added to a gardening product, such as, a mulch by blending homogeneously if desired, the colorant with the mulch. In one embodiment, the mulch can be blended with the colorant either before or at an agglomeration step. In a further embodiment, the dye can also be surface applied (wet or dry) after the agglomeration step.

The same methodology can be used for adding fragrances.

When dyes or fragrances are added to seeds, they can be added by homogeneously blending the seeds with the dyes or fragrances. In a further embodiment, the dyes or fragrances can be blended with the seeds before or at the agglomeration step. In a further embodiment, the dyes or fragrances can be applied to the seeds along with or mixed with binders in the same agglomeration step. In a further embodiment, the dyes or fragrances can also be surface applied (wet or dry) to the seeds after the agglomeration step. Dyes can also be added to the seed by using pre-dyed solid material as the coating

material. In a preferred embodiment, the dyes or fragrances are added to a coating that is added to the seed.

In a preferred embodiment, the agglomeration performed under the invention, is done by mechanical agitation, tumbling and mixer agglomeration, thermal processes, spray methods and liquid systems, spray coating, fluid bed dryer and spray dryer technology. Compaction or pressure agglomeration is a less preferred technique under the present invention.

In a further embodiment of the invention a dye or fragrance is provided to a seed or mulch which can assist a user in determining the acidity of the soil. In the case of a dye, the dye can change color and or becomes visible in response to the acidity of the soil. Therefore, a user can adjust the pH of the soil in response to the color of the seed or mulch.

In a further embodiment, the present invention provides a dye or fragrance to a seed or mulch, which can assist a user in determining the moisture levels added to the soil. In the case of a dye, the dye can change color or become visible in response to the moisture levels added to the soil. Therefore, a user can adjust the moisture level of the soil in response to the color of the seed or mulch.

In a further embodiment, the present invention provides a dye or fragrance to a seed or mulch, which can assist a user in determining the chemical content of the soil, such as whether there is enough nitrogen. In the case of a dye, the dye can change color or appear in response to the chemical content of the soil. Therefore, a user can adjust the chemical content of the soil in response to the color of the seed or mulch.

In a further embodiment, the present invention provides a dye to a seed or mulch to either prevent the soil from overheating or to assist in adding heat to the soil.

In a further embodiment, the present invention provides a dye or fragrance to a seed or mulch which deters animals such as birds from eating the seeds or mulch.

Mulch

U.S. Application 09/510,782 is incorporated by reference herein.

In one embodiment the dye or fragrance can be added to a fortified mulch. The fortified mulch can be made by paper fibers. This paper is placed in a mixer where NPK fortifiers and a binding agent, such as water, is added.

In one embodiment, the mulch of the present invention is made through an agglomeration/granulation process. A moist paper fiber based product can be impregnated with NPK (nitrogen, phosphorous, potassium) fortifiers in a mixer. The paper product is combined with the NPK fortifiers either before, or after entry into a mixer. The mixer performs work that results in an agglomerated (or granulated) product that is a homogeneous blend of the paper product and NPK fortifiers. Dyes are added to the mulch by homogeneously blending the colorant with the mulch. The mulch can be blended with the colorant either before or at an agglomeration step. The dye can also be surface applied (wet or dry) after the agglomeration step.

This product is then dried to a desired level of moisture and screened as necessary. A binding agent can be added at the mixer to enhance the agglomeration/granulation process. If a binding agent is added to the agglomeration process, the paper fiber based product need not be moist. In an embodiment, the dyes or fragrances can be applied to the mulch along with or mixed with binders in the same

agglomeration step. To increase the percent of on-sized product, a size reduction operation can be performed on the paper fiber product prior to entry into the mixer.

In an embodiment, a paper fiber based product, which can be moist, can be impregnated with NPK fortifiers in a mixer. The mixer is preferably a pin mixer, but can also be a pan pelletizer, paddle mixer, drum granulator or other type of mixer. The pin mixer is preferably a double helix pin arrangement. The paper fiber based product is comprised of a byproduct of a paper making process. Sewage sludge can be used to create the fortified mulch rather than or in addition to paper fibers.

Seed Capsules

U. S. Patent Application Nos. 09/113,254 and 09/544,878 is incorporated by reference. In one embodiment, is a combination seed capsule, comprising at least one viable seed, having an outer surface and acting as a core or pseudo-core of said combination seed capsule; and a coating of a composition comprising a soil conditioning material mounted proximate, including disposed outwardly of the outer surface of said seed. In a preferred embodiment, a dye or fragrance is added to the coating of the seed.

Preferably, the coating comprises the soil conditioning material in combination with at least one ingredient effective to reduce susceptibility of the seed capsule to deleterious affect of at least one of animals, weeds, and spore formers. In some embodiments, the ingredient for reducing such susceptibility of the seed capsule is selected from the group consisting of herbicides, fungicides, for example metalxyl, and a bitter substance.

The combination seed capsule can further comprise a second coating, separate from the first coating, and comprising at least one ingredient effective to reduce

susceptibility of the seed capsule to deleterious effect of at least one of animals, weeds, and spore farmers. In other embodiments, the second coating material is intermingled with the first coating material in an outer portion of the first coating, and generally displaced from the seed.

The second coating can comprise a plant nutrient, beneficial in location and in amount of availability, to a plant seedling emerging from the seed. The second coating composition can comprise an inorganic form of a plant nutrient and can be selected from the group consisting of nitrogen, phosphorous and potassium. The second coating can comprise an inorganic form of a plant nutrient and can be selected from the group consisting of e.g., urea, monammonium phosphate, diammonium phosphate, super phosphate, triple super phosphate, dicalcium phosphate, and potash or a micronutrient such as sulfur, manganese, copper, boron, iron, magnesium or chromium.

A preferred soil conditioning material is a sludge composition, such as a fiber-containing by-product of a paper making operation, or sewage sludge.

The seed capsule can comprise a water-leachable plant nutrient, and/or a leach retardant composition, such as wax, effective to retard leaching of the leachable plant nutrient out of the combination seed capsule.

In preferred embodiments, the coating remains generally disposed about the seed, and preferably but not necessarily remains generally intact about the seed, until the seed germinates.

The invention yet further comprehends a method of making a population of combination seed capsules, each comprising a seed, and a coating of a soil conditioning material, the method comprising pre-coating the seed with a material which enhances the

ability of the seed to act as a nucleus in an agglomeration operation to form a pre-coated substrate; and subsequently coating the pre-coated substrate with a soil conditioning material.

In general, the coating step typically results in an overall increase in the density of pre-coated seed combination. The coating step can be accomplished by, for example, spraying the pre-coated material onto the seed, and subsequently driving off such as by drying, as necessary, any solvent or other liquid carrier used for application of the coating material to the seed.

In general, at least one seed substrate and at least one soil conditioning material are selected as raw materials, and are combined to make a combination soil conditioning seed capsule product of the invention. To this combination seed capsule is added a dye or fragrance.

The invention can operate with any of a wide variety of soil conditioning materials such as municipal or other sewage sludge, scrubber sludge, paper mill sludge, fly ash, dust, animal waste, other organic materials, inorganic materials, and mineral soil conditioning materials. The soil conditioning material can be a solid material.

Natural lignin, lignosulfonates, water, and the like, may serve as suitable binders where the soil conditioning material is, for example, paper mill sludge, raw wood, sewage sludge, or other organic or inorganic material.

The coating material may be mixed with the seed in an (e.g. ribbon) blender, or may be otherwise coated onto the substrate seed in an agglomeration process according to well-known conventional agglomeration principles.

In some embodiments, a second coating material may penetrate into the layer of soil conditioning coating material. Such penetration may comprise a generally uniform distribution of the second coating material throughout the first coating material, or may represent a more stratified or otherwise heterogeneous distribution of second coating material in or on the first coating material.

In other embodiments, the coating materials may be mixed into a heterogeneous layer. Such layer or layers of heterogeneous material can then be coated upon the outside surface of the seed.

An illustrated method of applying the binder to the substrate seed or precursor seed capsule is by using a rotating drum spray-coating apparatus. Other apparatus and methods, for example a tilted pan coating process, can be used to apply the soil conditioning material and optionally an inorganic chemical fertilizer material onto the substrate seed.

Binder material applied as may contain additional coating components such as e.g. flyash, lime, gypsum, or the like. Thus, a first binder layer may underlie or be mixed with the soil conditioning coating material, and may be overlain by a second layer of the soil conditioning coating material.

Further, it is contemplated that the soil conditioning coating may be applied first, followed by application of binder or inorganic fertilizer or sealer coating, in which case the binder or inorganic fertilizer or sealer may serve as an outer shell, temporarily trapping the inwardly-disposed materials inside the seed capsule. In the alternative, the soil conditioning coating may be applied first, followed by application of the binder, wherein the binder penetrates through the soil conditioning coating, either physically or

chemically, to the underlying substrate seed and provides the binding property, as one or more components for assisting in adding bulk and thickness to an inner binder layer prior to any, or the majority of, the application of the organic coating material.

It should be understood that the more porous the established soil conditioning coating, or e.g. the outer surface of such coating, the more any subsequent spray material penetrates the established coating. All such penetration is contemplated in use of the term “coating” herein.

In some preferred embodiments, the overall coated combination seed capsule product comprises seed capsules wherein substantially the entirety of the soil conditioning material is confined to a contiguously-defined portion of the seed capsule. In such embodiments, the structures of the finished product seed capsules comprise coatings of contiguously arranged elements of the soil conditioning material, generally arrayed entirely or substantially entirely about the seed, which coatings may be overlain by an additional layer, optionally discontinuous, of organic or inorganic chemical fertilizer.

In addition, or in the alternative, other layers of other materials whether soil conditioning materials, organic or inorganic fertilizers, or other materials, can be applied to the substrate seed before applying the above mentioned layer of soil conditioning sludge.

Further to the structure of the seed capsules, the coatings on the seed capsules need not generally represent a uniform mixture of the inorganic chemical fertilizer and the soil conditioner. Rather, in a typical seed capsule a core substrate seed is overlain or

encapsulated by a soil conditioning material, and is generally free from a second overlying soil conditioning coating material.

The second coating can, and preferably does, in some embodiments, penetrate into voids or other interstices in an underlying e.g. soil conditioning coating. However, preferably most if not all elements of the underlying e.g. soil conditioning coating material are generally interconnected with each other without intervening coating material of the second layer, except for an optional binder used to hold the first coating material together as a unitary structure, separate from any structure and bonding provided by the second coating material.

In a preferred embodiment the coating process operates according to conventional and generally well known agglomeration principles, as described by Wolfgang B. Pietsch in an article entitled "The Agglomerative Behavior Of Fine Particles." Such coating process uses water and heat, along with physical and/or chemical adhesives and like properties, to bind or agglomerate a plurality of types of particles and/or materials into coated seed capsules, each typically containing an individual seed.

In some embodiments of the coating/agglomeration process, it is desirable to pre-coat the seeds prior to implementing agglomeration principles to produce the above described coating of soil conditioning material.

The seeds, whether pre-coated or not pre-coated, and the one or more soil conditioners, are received within a mixer where growth enhancers such as time release agents and/or other environmental conditioners may be added to form a combination seed capsule. The seeds are then received into a pan pelletizer, a rotary drum, or the like, where binders such as water, lignin, lignosulphonates, molasses, sodium silicate, wax,

